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Forest Health Protection
Pacific Southwest Region

Date: March 2, 2016
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To: Forest Supervisors (Eldorado, Inyo, Lassen, Modoc, Plumas, Sierra, Stanislaus, Sequoia and Tahoe National Forests and the Lake Tahoe Basin Management Unit), Park Superintendents (Sequoia Kings Canyon and Yosemite National Parks), Field Managers (Bureau of Land Management, Eagle Lake and Alturas Field Offices), and Deputy Director (CAL FIRE Resource Management)

Subject: Douglas-fir Tussock Moth: Results of 2015 Pheromone Detection Survey (FHP Report NE16-03)

Enclosed are the results of the 2015 cooperative Douglas-fir tussock moth (DFTM) pheromone detection survey. Participation in this effort includes the US Forest Service, CAL FIRE, Bureau of Land Management and the National Park Service.

Report Summary

- Douglas-fir tussock moth trap catches were extremely low in all survey areas except the Big Valley Ranger District, Modoc National Forest; an area that was not part of the 2013-2014 outbreak.

- No defoliation was reported anywhere in 2015, confirming the collapse of the 2013-2014 outbreak.

- White fir are recovering in nearly all areas affected by the outbreak. Areas of top-kill and whole tree mortality are mostly associated with small heavily defoliated areas and/or areas that were defoliated in both 2013 and 2014.

Results

Traps were installed in 144 plots this year with 96% reporting. Fewer than 3% of plots averaged > 25 male moths per trap (Table 1). A greater than 25 per trap average is considered high and follow up egg mass and/or larval density surveys are conducted on these plots to determine the potential for defoliation in the coming year. The 4 high count plots in 2015 were located on the Modoc NF (3 plots) and 1 plot on private timberland in Modoc County (monitored by CAL

FIRE). Forest Health Protection and CAL FIRE personnel will conduct larval surveys in late spring/early summer at high count plots.

Effects of recent outbreak

Nearly all areas affected by the recent outbreak are seeing a full recovery of defoliated white fir. Even the most affected areas are showing partial crown recovery with only scattered top-kill or whole tree mortality (Figure 1).

Figure 1. Top: White fir defoliated by Douglas-fir tussock moth in 2014, Plumas National Forest
Bottom: Same location in 2015 showing partial crown recovery in some trees and top-kill in others.

2016 Survey

Forest Health Protection and/or CAL FIRE Pest Management staff will conduct additional monitoring and report any defoliation to the appropriate land managers. Field going personnel are urged to continue to check for evidence of feeding and defoliation on white fir this coming summer and fall and report any findings to your local forest health contacts (Appendix B).

Trapping materials have been ordered for the detection survey plots for 2016 and will be distributed to cooperators in June or July. Updates on population monitoring will be distributed to land managers as needed.

Forest Health Protection appreciates the continued cooperation from all agencies in this ongoing west-wide survey effort and especially thanks the following DFTM Detection Survey cooperators:

Don Owen, CAL FIRE, Redding
Tom Smith, CAL FIRE, Davis
Jim Kral, CAL FIRE, Mountain Home DSF
David Shy, CAL FIRE, Tulare
Frank Spandler, CALFIRE Tulare
Tom Warner, NPS, Sequoia Kings Canyon
Brian Mattos, NPS, Yosemite
Cliff Motheral, BLM, Susanville
Peter Hall, BLM, Alturas
Ryan Tompkins, Plumas NF
Cathy Carlock, Modoc NF
Barbara Bryan, Modoc NF
Sandy Tiffin, Lassen NF
Matt Cerney, Lassen NF
Paul White, Lassen NF
Charlie Hiles, Tahoe NF
Kelly Bowdoin, Tahoe NF
Jerald Griffin, Tahoe NF
James Ingram, Eldorado NF
Jeff Griffin, Eldorado NF
Bob Carroll, Eldorado NF
Dana Walsh, Eldorado NF
Rodney Wilson, Stanislaus NF
Kathy Stillwell, Stanislaus NF
David Vosti, Stanislaus NF
Maria Benech, Stanislaus NF
Francey Blaugrund, Sierra NF
Dave Smith, Sierra NF
George Powell, Sequoia NF
John Springer, Sequoia NF
Andrew Weinhart, Inyo NF
Scott Kusumoto, Inyo NF
Rita Mustatia, LTBMU
Paul Guarnaccia, LTBMU

If you have any questions regarding this report and/or need additional site specific information please contact Danny Cluck at 530-252-6431.

/s/ Danny Cluck

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Forest Entomologist
NE CA Shared Service Area

cc: Forest Health Protection, Regional Office
Beverly Bulaon, Stanislaus NF

Table 1. Number of Douglas-fir tussock moth pheromone detection survey plots by trap catch for 1998 - 2015 for California.

Year	# of plots reported/ % reported	NUMBER OF PLOTS WITH AN AVERAGE MOTH CATCH PER TRAP OF:														
		0<10	10<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75+
1998	159	81	22	11	9	6	3	10	7	5	2	1	1	1	0
	100%	51%	14%	7%	6%	3%	2%	6%	4%	3%	<1%	<1%	<1%	<1%	
1999	159	126	20	5	3	2	2	0	0	0	1	0	0	0	0
	100%	79%	13%	3%	2%	1%	1%				1%				
2000	185	154	15	4	4	0	1	2	2	2	0	0	1	0	0
	100%	83%	8%	2%	2%		<1%	1%	1%	1%			<1%		
2001	183	95	57	13	10	6	0	1	1	0	0	0	0	0	0
	100%	52%	31%	7%	5%	3%		<1%	<1%						
2002	168	126	31	5	3	3	0	0	0	0	0	0	0	0	0
	100%	75%	18%	3%	2%	2%									
2003	163	53	42	11	11	10	14	13	3	1	4	0	1	0	0
	100%	32%	26%	7%	7%	6%	8%	8%	2%	1%	2%		1%		
2004	174	68	43	6	16	11	6	5	3	0	2	1	1	0	0
	* 93%	39%	25%	3%	9%	6%	3%	3%	2%		1%	<1%	<1%		
2005	195	139	15	11	7	4	3	2	3	1	0	0	0	1	1
	*95%	71%	8%	5%	4%	2%	2%	1%	2%	<1%				<1%	<1%
2006	164	98	26	8	8	5	3	4	3	4	2	0	1	1	1
	100%	60%	16%	5%	5%	3%	2%	2%	2%	2%	2%		<1%	<1%	<1%
2007	164	157	6	0	0	1	0	0	0	0	0	0	0	0	0
	100%	96%	4%			<1%									
2008	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	100%													
2009	147	144	3	0	0	0	0	0	0	0	0	0	0	0	0
	*93%	98%	2%												
2010	142	134	6	2	0	0	0	0	0	0	0	0	0	0	0
	*90%	95%	4%	1%											
2011	146	100	23	5	7	5	2	2	1	2	1	0	0	0	0
	*90%	68%	16%	3%	5%	3%	1%	1%	<1%	1%	<1%				
2012	133	76	18	5	7	4	7	3	4	4	4	1	1	0	0
	*82%	57%	14%	4%	5%	3%	5%	2%	3%	3%	3%	<1%	<1%		
2013	137	79	14	6	5	5	4	6	5	2	4	1	2	1	3
	*78%	58%	10%	4%	4%	4%	3%	4%	4%	2%	3%	<1%	2%	<1%	2%
2014	130	86	14	8	5	7	1	0	1	2	2	1	2	1	0
	*80%	66%	11%	6%	4%	5%	<1%		<1%	2%	2%	<1%	2%	<1%	
2015	144	124	8	2	1	2	0	1	0	0	0	0	0	0	0
	*96%	90%	6%	1%	<1%	1%		<1%							

*some traps burned in recent fires

Appendix A: Douglas-fir Tussock Moth Biology and Management

The Douglas-fir tussock moth (DFTM), *Orgyia pseudotsugata,* is an important defoliator of white fir in California. Outbreaks of the native insect occur somewhere in the state about every 10 years. These outbreaks arise abruptly, but generally subside within one to two years. White fir is the primary host, but other tree species may be defoliated during outbreaks. Defoliation by DFTM may weaken, kill, or top-kill trees. Heavily defoliated trees may experience reduced growth for several years post outbreak and be more susceptible to attacks by bark beetles. Ninety percent of mortality occurs in trees that are ≥ 90% defoliated, while trees with ≤ 50% defoliation rarely die. Top-kill follows a similar trend.

Defoliation first appears in late spring. Larvae from newly-hatched eggs feed on current year's foliage, causing it to shrivel and turn brown. Older larvae may feed on both current and old foliage, although current needles are preferred. Defoliation occurs first in the tops of the trees and the outermost portions of the branches, and then in the lower crown and farther back on the branches.

Douglas-fir tussock moth larvae (differences in color and size are due to stage of development).

The adult male is a gray-brown to black-brown moth with feathery antennae and a wingspread of 1 to 1 1/4 inches. The forewings are gray brown and have two distinct, irregular dark bars and two vague whitish spots. The hindwings are a contrasting brown. The female has tiny rudimentary wings, small threadlike antennae, and a large abdomen. Young larvae are 1/8 to 1/4 inch long and have long, fine body hairs which later develop into tufts. Mature larvae are up to 1 1/4 inches long and very colorful. Two long, dark tufts or pencils of hair similar to horns are located right behind the head. Four dense, buff colored tussocks are located forward along the middle of the back. The rest of the body except for the legs and head is covered with short hairs radiating from red, button like centers (see photo).

The DFTM produces one generation per year. Females mate soon after they emerge from their pupal cocoon. Eggs hatch in early June, coincident with bud break and shoot elongation of host trees. The larvae pass through four to six instars and pupate toward the end of the July. The pupal stage lasts from 10-18 days depending on temperature.

Natural controls keep DFTM populations low most of the time. There is some indication that fir growing on pine sites and fir stands located on warm, dry sites are most susceptible to damage. In these forest situations, silvicultural treatments that reduce the number of susceptible hosts and decrease the multi-storied characteristics of host stands are recommended to prevent outbreaks.

When population levels are high enough to cause unacceptable damage, methods of direct control are available. The viral insecticide, TM-Biocontrol-1, is currently registered in California for use against DFTM. Other registered insecticides are also effective against DFTM including broad spectrum insecticides and more targeted growth regulators and microbial insecticides. Applications of insecticides are made aerially over large areas or with ground based equipment on individual trees. Where DFTM-caused defoliation is expected in high value areas, such as recreation areas or on individual high-value trees, pesticide use may be warranted to minimize tree mortality and reduce public exposure to the insect.

Public Health Concerns

The hairs on the caterpillars as well as their egg masses and cocoons may cause allergic reactions in some people. Itching is the most common complaint, but adverse health effects can include rashes (with welts or blisters), watery eyes, runny nose, cough and, less commonly, shortness of breath, wheezing, and chest tightness. Hot weather and perspiration increase the severity of symptoms, and people with a history of allergies may be more susceptible to "tussockosis." Accidental disturbance or handling of old larval skins and spent cocoons, deposited under leaf litter, bark, wood piles, timber, or any other material that caterpillars have touched, can result in irritation. Irritation intensity depends upon the amount of contact with the caterpillar and the sensitivity of the person. The effects may be cumulative, with successive exposures resulting in elevated symptoms. During a 1998 outbreak at Grant Grove in Kings Canyon National Park, approximately 100 people sought medical attention or advice, resulting in a temporary closure of the area for health and safety reasons.

Additional information on DFTM:

"White fir recovery following Douglas-fir tussock moth Bear Mountain outbreak" found at http://caforestpestcouncil.org/resources/

Forest Insect and Disease Leaflet 86: http://www.na.fs.fed.us/spfo/pubs/fidls/tussock/fidl-tuss.htm

Appendix B: Forest Health Contacts

Region 5, Forest Health Protection, Service Area Contacts

Northern CA (National Forests: Klamath, Mendocino, Shasta-Trinity, Six Rivers)

Plant Pathologist:	Pete Angwin (530) 226-2436 e-mail: pangwin@fs.fed.us
Entomologist:	Cynthia Snyder (530) 226-2437 e-mail : clsnyder@fs.fed.us

Northeastern CA (National Forests: Lassen, Modoc, Plumas, Tahoe)

Plant Pathologist: Bill Woodruff
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Entomologist: Danny Cluck
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e-mail: dcluck@fs.fed.us

South Sierra (National Forests: Eldorado, Inyo, LTBMU, Sequoia, Sierra, Stanislaus)

Plant Pathologist: Martin MacKenzie
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Entomologist: Beverly M. Bulaon
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Southern CA (National Forests: Angeles, Cleveland, Los Padres, San Bernardino)

Plant Pathologist: Melody Lardner
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CAL FIRE, Forest Pest Management Contacts

Cascade and Northern Sierra:

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